‘Recessions, healthy no more?’: A note on Recessions, Gender and Mortality in France

Josselin Thuilliez

UNIVERSITÉ PARIS 1
PANTHÉON SORBONNE

Documents de Travail du
Centre d'Economie de la Sorbonne

CES Working Papers

'Recessions, healthy no more?': A note on Recessions, Gender and Mortality in France

Josselin THUILLIEZ

2016.08

Maison des Sciences Économiques, 106-112 boulevard de L'Hôpital, 75647 Paris Cedex 13
http://centredeconomiesorbonne.univ-paris1.fr/
ISSN : 1955-611X

‘Recessions, healthy no more?’: A note on Recessions, Gender and Mortality in France.*

Josselin Thuilliez†

January 7, 2016

*I would like to thank the CépiDc for the data used in this analysis.

†CNRS - Centre d’économie de la Sorbonne. 106-112, Boulevard de l’Hôpital. 75013 Paris. E-mail: josselin.thuilliez@univ-paris1.fr

Abstract

This study uses aggregate panel data on 96 French *départements* from 1982 to 2012 to investigate the relationship between macroeconomic conditions, gender and mortality. I use previously employed panel data methods, based on mortality variation across French *départements* and years. The novelty is to analyze the effect of gender-specific unemployment on gender-specific mortality. Within this "area-gender approach", I give a particular attention to gender-cause-specific mortality such as prostate cancer, maternal mortality, female breast cancer, cervical cancer and ovarian cancer in addition to other cause-specific mortality. The analysis is undertaken for several age-groups, several time windows and different geographical aggregates of unemployment. The results reveal that the relationship between unemployment and mortality in France is weak and confirm recent conclusions from U.S. state-level analysis by Rhum [Ruhm, C.J., 2015. Recessions, Healthy no more?. Journal of Health Economics 42, 17–28].

Keywords*: Health, Mortality, Recessions, Gender, Macroeconomic conditions*
JEL: E32, I12, J2

1 Introduction

Recent research has drawn a refined picture of the relationship between mortality and economic conditions (Lindo, 2015; Ruhm, 2015). However, the conclusions are mixed. The collection of studies already at hand shows that the strength and significance of the relationship vary across periods of analysis (Ruhm, 2015), levels of geographic aggregation (Lindo, 2015; Currie, Duque and Garfinkel, 2015), countries or groups of countries (Granados, 2005; Buchmueller et al., 2007; Lin, 2009; Gonzalez and Quast, 2010, 2011), sources of death (Neumayer, 2004), age-groups (Dehejia and Lleras-Muney, 2004; Stevens et al., 2011; Ruhm, 2015). In this study, I focus on one additional dimension, namely gender-specific effects. Indeed, the so-called "area approach" relies on the assumption that the relationship is not gender-specific. As a consequence, gender-specific unemployment rates have been neglected in empirical models. However, proxies of economic conditions, such as unemployment, may vary substantially across genders *and* areas.

This paper's main contribution is twofold. First, I update previous results from the only unpublished French study case in this field of research (Buchmueller et al., 2007). I examine how health responds to transitory changes in economic conditions within 96 French *départements* from 1982 to 2012. Fixed-effect (FE) models are estimated using longitudinal data and the classical "area approach". Buchmueller et al. (2007) found that increases in the local unemployment rates are associated with reductions in mortality from 1982 to 2002. The negative relationship between unemployment and mortality was also found to be strongest for deaths due to cardiovascular disease and accidents. I examine this question on a longer time-frame. Moreover, by including data that incorporates the Great Recession (from mid-2007 to the beginning of 2010), I am able to exploit greater exogenous variation in the unemployment rate across *départements* and years, as compared to studies using pre-Great Recession data in France (Buchmueller et al., 2007). In addition, Ruhm (2015) finds that over a long period (1976-2010), total mortality shifted from strongly procyclical to being weakly related to macroeconomic conditions in the US. I also examine this question by using different sample windows for the French case. Second, I examine the gender-specific relationship between unemployment and mortality. Using an "area-gender approach" has several advantages for empirical identification. The first advantage is that the sources of variation are multiplied, and I can therefore control for more unobserved factors with the use of time-gender, area-gender and time-area fixed effects. As any lengthy time series is likely to suffer from omitted variable bias, this is a substantial added-value. The second advantage is that some sources of death are exclusively related to gender (e.g. prostate cancer mortality), allowing one to better isolate the specific effects of gender-specific unemployment and associated spillover effects. It is important to note that, when possible, unemployment rates are measured at two levels of geographic aggregation (*régions* and *départements*) and results are provided for several age-groups and specific causes of death which provide information on different dimensions of the relationship between unemployment and mortality.

The underlying mechanisms behind the relationship between unemployment and mortality are not fully understood. On the one hand, the medical literature considers unemployment as a psychosocial stressor. Recessions have thus been associated with increased mortality due to cardiovascular disease, cirrhosis, suicide, and homicide (Brenner, 1971, 1975, 1979; Brenner and Forbes, 1981; Brenner and Mooney, 1983; Brenner, 1987; Iversen, 1989). Falling incomes during economic contractions could also lower quality of life and well-being of unemployed individuals. Downward mobility could also be damaging and may be associated with increased morbidity and mortality. On the other hand, rising opportunity cost of time that accompanies better labor market opportunities might lead to higher mortality (Miller et al., 2009) because it makes it more costly for individuals to undertake time-intensive health-producing activities. Health is also an input into the production of goods and services (Sokejima and Kagamimori, 1998; Ruhm, 2003) and, as a consequence, declines in production or wages could lead to changes in overall health. Finally, income growth may increase risky activities such as drinking and driving (Ruhm and Black, 2002).

Men and women may be affected differently in this framework. According to Wilson and Walker (1993), unemployed men and their families have increased mortality experience, particularly from suicide and lung cancer. Unemployed men also have a reduction in psychological well-being with a greater incidence of suicide, depression and anxiety. Women are less affected by enforced unemployment, but families are put at greater risk of physical illness, psychological stress and family breakdown (Wilson and Walker, 1993). Based on a population of almost 50,000 Swedish men born 1949–51, Lundin et al. (2010) found an increased risk of mortality 1995–2003 among individuals who experienced 90 days or more of unemployment during 1992–4 compared with those still employed but a substantial part of the increased relative risk of mortality associated with unemployment might be attributable to confounding by individual risk factors. Currie, Duque and Garfinkel (2015) found that the Great Recession decreased self-reported health status and increased smoking and drug use amongst mothers.

My main findings are as follows. First, the association is likely to be poorly measured when using short analysis periods, as previously emphasized by Ruhm (2015). Second, the estimated links between economic conditions and mortality are sensitive to gender variation in unemployment rates. However, spillover effects across genders are limited. Third, the relationship between unemployment and mortality is weak in France though I find heterogeneous responses.

This note is organized as follows. The next section describes the research design. Section 3 describes the data. In Section 4, I provide the results for total mortality and specific sources of death and age groups. Section 5 concludes.

2 Research Design

2.1 Area Approach

My analysis starts by using previously employed "area approach" (Ruhm, 2000, 2015). The data comprises 2,976 observations corresponding to 96 departments, and 31 years (1982-2012). For a specific source of death, in *département* j, at year t, I estimate the following equation:

$$ln(Mort_{j,t}) = \lambda U_{j,t} + \beta X_{j,t} + \delta_j + \delta_t + \theta_j t + \epsilon_{j,t} \quad (1)$$

where U is the state unemployment rate, X a vector of covariates, δ_j state fixed-effects, δ_t year fixed-effects, and $\theta_j t$ *département*-specific time trends. The coefficient of interest is λ, which measures the effect of unemployment on the natural log of the mortality rate (deaths per 100,000). X includes the fraction of the state population that is less than five years old, is 5–64 years old, is greater than 64 years old. The results have been shown to be relatively insensitive to the inclusion of many more controls at the county level in the US (Lindo, 2015). In my main specification, the dependent variable is the natural log of the mortality rate in département i in year t. I also report models where the dependent variable is the number of deaths per 100,000 persons.

2.2 Area-Gender Approach

Second, I use differential variation in gender-specific unemployment rates across French *départments* or *régions* as an additional source of variation in mortality. This approach can be thought as a DDD strategy. The first difference is over time. The second is across geographic areas (départements); the magnitude of unemployment increases and declines varied considerably across France's 96 departments. The third difference is between genders. Moreover, some causes of death are unique in that they exclusively pertains to women or men. I am able to test this approach on two databases. The first is a longitudinal database similar to the previous one for which I have data on both gender-specific mortality at the *département* level and gender-specific unemployment at the *région* level. However, data availability requires to restrict the analysis from 1991 to 2009 (19 years, 96 départements, 2 genders; 3,648 observations). I am also able to replicate this analysis with unemployment and mortality rates at both the *département* and *région* levels on census years. The data comprises 960 observations corresponding to a gender (2), department (96), and year (1982, 1990, 1999, 2006, 2011). Note that the time period of analysis is still over 15 years in this case. The estimating equation is:

$$ln(Mort_{j,t,g}) = \lambda U_{j,t,g} + \beta X_{j,t,g} + \delta_{j,g} + \delta_{t,g} + \delta_{j,t} + \theta_{j,g}t + \epsilon_{j,t,g} \tag{2}$$

where g denotes gender, $Male$ is a dummy for Male $\delta_{j,g}$, $\delta_{t,g}$ and $\delta_{j,t}$ are district-gender, district-year, and gender-year fixed-effects, and $\theta_{j,g}t$ is a *département*-gender specific trend. An interaction between gender and $U_{j,t,g}$ is added in an alternative specification of this equation. X is a vector of gender-time-varying controls. For questions of comparability between the "area approach" and the "gender-area approach", Table A3 and A4 replicate Table 1 and 2 over the 1991-2009 period and census years.

3 Data and descriptive statistics

3.1 Data

Mortality data are from the *Centre d'épidémiologie sur les causes médicales de décès* (CépiDc)[1]. The CépiDc maintains a database with currently more than 20 million records (deaths since 1979). Statistics on deaths are based on information gathered from two documents: the medical certificate and the bulletin of civil status of death. Total deaths are available by *département*, year, gender, and age (five-year groups). In the administrative divisions of France, the *département* is one of the three levels of government below the national level, between the 27 administrative *régions* and the *commune*. The data are thus disaggregated geographically into 96 *département*. The mortality data are believed to be of excellent quality.

Bridges have been established between ICD-9 and ICD-10 coding systems (Anderson et al., 2001). These issues are typically minor when looking at broad causes of death (e.g. those from malignant neoplasms) but may be important for many specific sources of mortality (Ruhm, 2015). Appendix Table A1 details the ICD codes used to classify causes of death and the corresponding estimated comparability ratios from Anderson et al. (2001). For the specific sources of mortality I am considering, most of the estimated comparability ratios are close to one and, as a consequence, a similar number of deaths are reported using either ICD system. Issues of data comparability are likely to be minor and well captured by the inclusion of regression year fixed-effects (Ruhm, 2015). Appendix Table A2 provides mortality rates (per 100,000 population) by gender and shows how the sources of death changed over the analysis period, showing numbers and shares of fatalities from 1982 to 2001, from 1993 to 2012, and from 1982 to 2012.

Population data and unemployment data were collected from the *Institut National de la Statistique et des études économiques* (*INSEE*)[2]. As unemployment is the core issue of my paper, I rely on official statistics provided by INSEE. Official statistics *by gender* are only available at the *région* level from 1991 to 2009[3].

[1]http://www.cepidc.inserm.fr/site4/ and http://www.cepidc.inserm.fr/site4/index.php?p=indicateurs.

[2]http://www.insee.fr/fr/insee-statistique-publique/default.asp?page=connaitre/ddar.htm.

[3]For details on how unemployment statistics are calculated in France, see Fougere, Kramarz and Pouget (2009) or http://www.insee.fr/en/methodes/default.asp?page=sources/ope-taux-chomage-localises.htm.

3.2 Graphical exploration

I begin my analysis with a graphical exploration of the relationship between unemployment and mortality. Figure 1 displays national total mortality and unemployment rates in each year. Mortality and unemployment are measured at the *département* level. The variables are detrended, using a linear trend, and normalized by subtracting the mean of the detrended variable and dividing by its standard deviation (Ruhm, 2000).

Figure 2 and 3 combine the results from Ruhm (2015) and Lindo (2015). They display unemployment coefficients using 5-year, 10-Year and 12-year, 20-year sample windows beginning in the specified year but using different geographical aggregation of unemployment rates. Figure 2 uses unemployment rate at the *département* level. Figure 3 uses unemployment rates at the *région* level. These descriptive results confirm that the association is sensitive to the time period of analysis - relatively shorter periods showing more instability - and that more disaggregated measures of unemployment produce estimates that are smaller in magnitude.

Figure 4 reproduces Figure 1 by gender. Gender-specific mortality is measured at the *département* level and gender-specific unemployment at the *région* level. The variables are detrended, using a linear trend, and normalized by subtracting the mean of the detrended variable and dividing by its standard deviation.

Figure 5 provides gender-specific unemployment coefficients using 2-Year, 5-year, 10-Year and 12-year windows beginning in the specified year between 1991 and 2007. Mortality rates are measured at the *département* level and unemployment are measured at *région* level. This analysis shows that the results are not only sensitive to the time period and the level of analysis, but also to gender. For instance, the curve providing the 5-year window shows more stability than the equivalent curve in Figure 3.

Lastly, Figure 6 reproduces Figure 5 for gender-specific causes of death. Prostate cancer mortality, maternal mortality, female breast cancer, cervical cancer and ovarian cancer are represented in this figure. In addition, as France stands out from other countries for having a high suicide rate, particularly amongst men, I provide suicide and transport accidents for external causes of death for comparison. Overall, I find no effect of gender-specific unemployment on gender-specific mortality rates, even for suicide or transport accidents, some causes of death often found to vary counter-cyclically (Brainerd, 2001).

4 Results

4.1 Area Approach

Table 1 summarizes subgroup analyzes, stratified by gender and age. Total mortality varies counter-cyclically over the full period of analysis (1982-2012) in columns (3) and (6). For age-specific mortality, the only age groups for which mortality varies pro-cyclically are the youngest one, 0-24 years old, and the 65-74 years old. Male mortality seems to vary counter-cyclically as well, while female mortality is not significantly impacted by general unemployment. The same analysis on sub-periods (1982-2001; 1993-2012) do not provide significant and consistent results.

Table 2 stratifies diseases (including mental health) versus external sources of death over the 1982-2012 period (columns 3 and 6). There is heterogeneity in the effects for specific sources of deaths but except transport accidents, all significant effects are positive (cardiovascular diseases, maternal mortality, female breast cancer, drugs addiction, alcohol problems).

Table A3 and A4 provide additional periods of analysis (1991-2009 or census years 1982, 1990, 1999, 2006, 2011). The main results on census years are globally similar to the results obtained from the full panel of data, though the order of magnitude are higher. Results on 1991-2009 are not significant with some exceptions, e.g. the coefficient on transport accidents being negative and significant.

4.2 Area-Gender Approach

Our previous analysis focused on equation (1). Table 3 and 4 present estimates of equation (2). Columns (1) and (3) provide the coefficients on gender-specific unemployment and columns (2) and (4) provide the coefficient on gender-specific unemployment interacted with a dummy for male, and gender-specific unemployment alone. Note that though the period of time is restricted to 1991-2009 - and therefore only directly comparable to Table A3 and A4 - the number of observations is much higher, even when compared with Tables 1 and 2. They should therefore be more precisely estimated. Columns (3) and (4) restrict the analysis to census years. The results are remarkably similar to those obtained from Table 1, 2, A1 and A2.

Overall, columns (1) and (3) provide no significant effects of gender-specific unemployment on gender-specific mortality, except for cancers (all types) and homicides in Table 4, column (3) and (1) respectively where the coefficients on unemployement are significantly negative. In columns (2) and (4), the coefficient on the interacted term is rarely significantly different from zero. For instance, it is significant in Table 3, column (4) where it is positive (total mortality).

Table 5 provides the results for gender-specific causes of death. Two variables are used separately for this analysis. I first look at the effect of gender-specific unemployment on gender-specific mortality using the same gender for both variables. Next I use the opposite gender in the regression analysis. Spillover effects across gender seem to play a role in the case prostate cancer where men and women unemployment affects men mortality negatively (columns 1 and 2) and female breast cancer, where only male unemployment affects female mortality positively (column 2).

4.3 Robustness tests

In Table 6, I make the following changes to test the robustness of the estimates on total mortality:

- Restrict the sample to 1991-2000, 2000-2009 and 2006-2009 during the great recession.
- Use the death rate as the outcome variable rather than the log of the death rate, which may be undefined in small counties.This changes the interpretation of the estimate, which indicates that a one-percentage-point increase in the unemployment rate is associated with 4.39 more deaths per 100,000 (Column 5), but this coefficient is not significant.
- Use the employment-to-population ratio as an alternative measure of economic conditions.

The main conclusions are not affected. The relationship between unemployment and mortality remains weak in France over the period of analysis.

5 Conclusions

Is recession good for your health? The answer to this question is not obvious. In France recessions seem to have little impact on total mortality. If any effect, this effect seems to be countercyclical - unemployment increasing total mortality - and heterogenous across sources of death, with limited spillover effects across genders. My results confirm recent results from Ruhm (2015) in the US, who found that total mortality is weakly or unrelated to macroeconomic conditions and that countercyclical patterns have emerged.

The results could reflect the universality of insurance coverage in France. Sickness, maternity and paternity insurance benefits are provided in Metropolitan France by the local Health Insurance Funds (Caisses Primaires d'Assurance Maladie / CPAM). To qualify for benefits, the claimant must have paid a certain amount in contributions or worked a certain number of hours within a given reference period. However, regular and permanent French residents who do not qualify for maternity/sickness benefits in kind as insured persons or dependents, are nevertheless entitled to receive such benefits under the Universal Health Insurance Coverage (CMU) program. Depending on their earnings, these persons may or may not have to pay a contribution for such benefits. The health insurance system provides in-kind benefits (reimbursement of healthcare costs) for insured persons and their dependents, and cash benefits (daily sickness benefits for temporary incapacity for work) for insured persons. I interpret my results as evidence that such transfers have been effective in France from 1982 to 2012.

Our results include some limitations. It is possible that mortality rates measured at a small local area are affected by migration. For instance, retired people may have migrated south and west to the band of *départements* known as the Sun Belt a few years before dying. However, this does not appear to be an issue, except in 2 regions (Baccaïni, 2001). Even to the extent that this type of migration occurs, there is little reason to expect it to be correlated with short-term changes in local unemployment rates, since it likely concerns retired individuals (Buchmueller et al., 2007). My specification of the relation is also particular to the time period of analysis (1982-2012 or 1991-2009); it is not satisfactory for any other different time span. Lastly, it could be particularly relevant to extend the "gender-area approach" over the full period of time (1982-2012) to confirm our results. Nonetheless, I think my analysis can inform the debate on recession and health in high income countries.

References

Anderson, R. N., A. M. Miniño, D. L. Hoyert, and H. M. Rosenberg. 2001. "Comparability of cause of death between ICD-9 and ICD-10: preliminary estimates." *National Vital Statistics Reports: From the Centers for Disease Control and Prevention, National Center for Health Statistics, National Vital Statistics System*, 49(2): 1–32.

Baccaïni, Brigitte. 2001. "Les migrations internes en France de 1990 à 1999: l'appel de l'Ouest." *Economie et statistique*, 344(1): 39–79.

Brainerd, Elizabeth. 2001. "Economic reform and mortality in the former Soviet Union: a study of the suicide epidemic in the 1990s." *European Economic Review*, 45(4): 1007–1019.

Brenner, M H. 1975. "Trends in alcohol consumption and associated illnesses. Some effects of economic changes." *American Journal of Public Health*, 65(12): 1279–1292.

Brenner, M. Harvey. 1971. "Economic changes and heart disease mortality." *American Journal of Public Health*, 61(3): 606–611.

Brenner, M. Harvey. 1979. "Mortality and the national economy: A review, and the experience of England and Wales, 1936-76." *The Lancet*, 314(8142): 568–573.

Brenner, M. Harvey. 1987. "Special Issue: Unemployment and HealthRelation of economic change to Swedish health and social well-being, 1950–1980." *Social Science & Medicine*, 25(2): 183–195.

Brenner, M. Harvey, and Anne Mooney. 1983. "Unemployment and health in the context of economic change." *Social Science & Medicine*, 17(16): 1125–1138.

Brenner, M. Harvey, and J. F. Forbes. 1981. "Unemployment and Health." *The Lancet*, 318(8251): 874–875.

Buchmueller, Thomas C., Michel Grignon, Florence Jusot, and Marc Perronnin. 2007. *Unemployment and mortality in France, 1982-2002.* Centre for Health Economics and Policy Analysis, McMaster University.

Currie, Janet, Valentina Duque, and Irwin Garfinkel. 2015. "The Great Recession and Mothers' Health." *The Economic Journal*, 125(588): F311–F346.

Dehejia, Rajeev, and Adriana Lleras-Muney. 2004. "Booms, Busts, and Babies' Health." *The Quarterly Journal of Economics*, 119(3): 1091–1130.

Fougere, Denis, Francis Kramarz, and Julien Pouget. 2009. "Youth Unemployment and Crime in France." *Journal of the European Economic Association*, 7(5): 909–938.

Gonzalez, Fidel, and Troy Quast. 2010. "Mortality and business cycles by level of development: Evidence from Mexico." *Social Science & Medicine*, 71(12): 2066–2073.

Gonzalez, Fidel, and Troy Quast. 2011. "Macroeconomic changes and mortality in Mexico." *Empirical Economics*, 40(2): 305–319.

Granados, José A. Tapia. 2005. "Recessions and mortality in Spain, 1980–1997." *European Journal of Population/Revue européenne de Démographie*, 21(4): 393–422.

Iversen, Lars. 1989. "Unemployment and mortality." *Stress Medicine*, 5(2): 85–92.

Lindo, Jason M. 2015. "Aggregation and the estimated effects of economic conditions on health." *Journal of Health Economics*, 40: 83–96.

Lin, Shin-Jong. 2009. "Economic fluctuations and health outcome: a panel analysis of Asia-Pacific countries." *Applied Economics*, 41(4): 519–530.

Lundin, A., I. Lundberg, L. Hallsten, J. Ottosson, and T. Hemmingsson. 2010. "Unemployment and mortality—a longitudinal prospective study on selection and causation in 49321 Swedish middle-aged men." *Journal of Epidemiology and Community Health*, 64(01): 22–28.

Miller, Douglas L., Marianne E. Page, Ann Huff Stevens, and Mateusz Filipski. 2009. "Why are recessions good for your health?" *The American Economic Review*, 122–127.

Neumayer, Eric. 2004. "Recessions lower (some) mortality rates:: evidence from Germany." *Social science & medicine*, 58(6): 1037–1047.

Ruhm, Christopher J. 2000. "Are Recessions Good for Your Health?" *The Quarterly Journal of Economics*, 115(2): 617–650.

Ruhm, Christopher J. 2003. “Good times make you sick.” *Journal of health economics*, 22(4): 637–658.

Ruhm, Christopher J. 2015. “Recessions, healthy no more?” *Journal of Health Economics*, 42: 17–28.

Ruhm, Christopher J., and William E. Black. 2002. “Does drinking really decrease in bad times?” *Journal of health economics*, 21(4): 659–678.

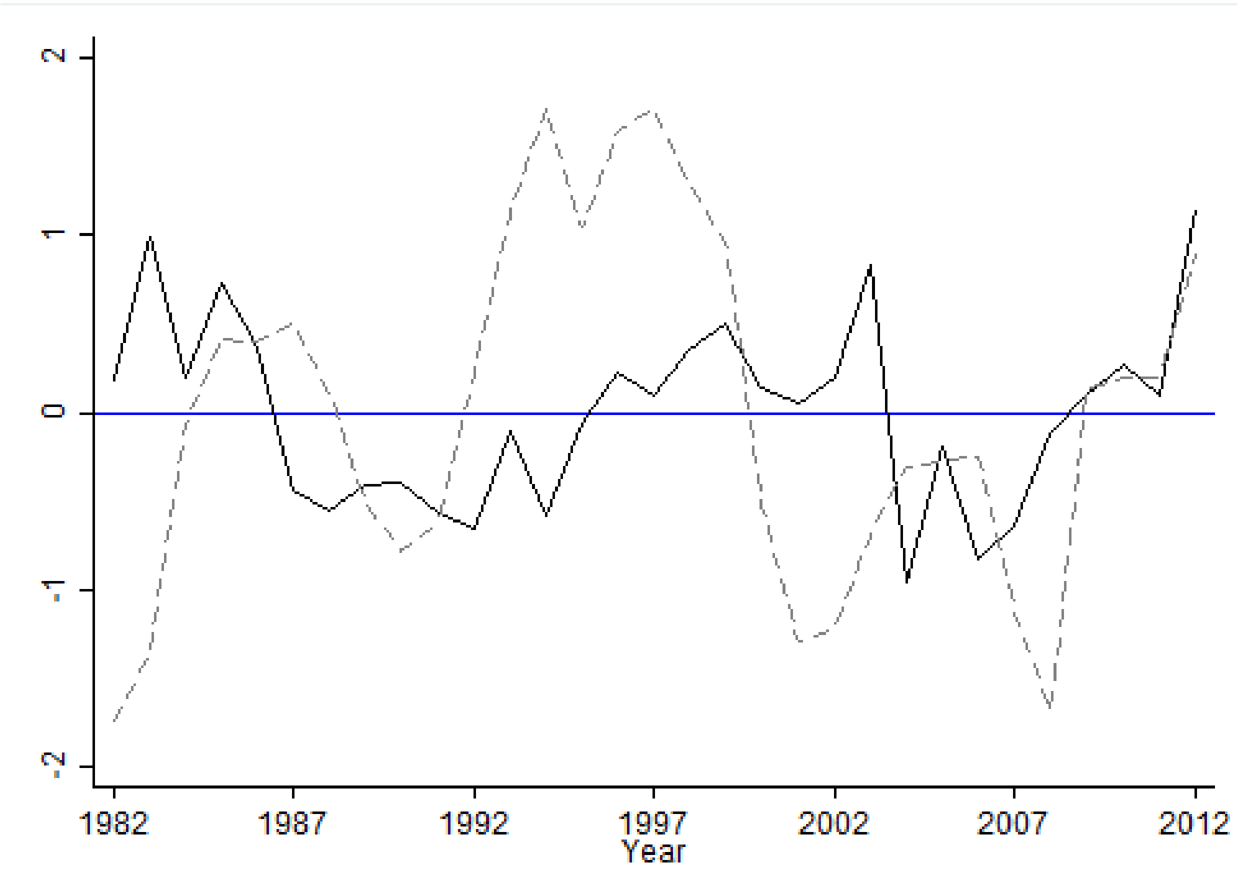
Sokejima, S., and S. Kagamimori. 1998. “Working hours as a risk factor for acute myocardial infarction in Japan: case-control study.” *BMJ (Clinical research ed.)*, 317(7161): 775–780.

Stevens, Ann Huff, Douglas L. Miller, Marianne E. Page, and Mateusz Filipski. 2011. “The best of times, the worst of times: Understanding pro-cyclical mortality.” National Bureau of Economic Research.

Wilson, S. H., and G. M. Walker. 1993. “Unemployment and health: A review.” *Public Health*, 107(3): 153–162.

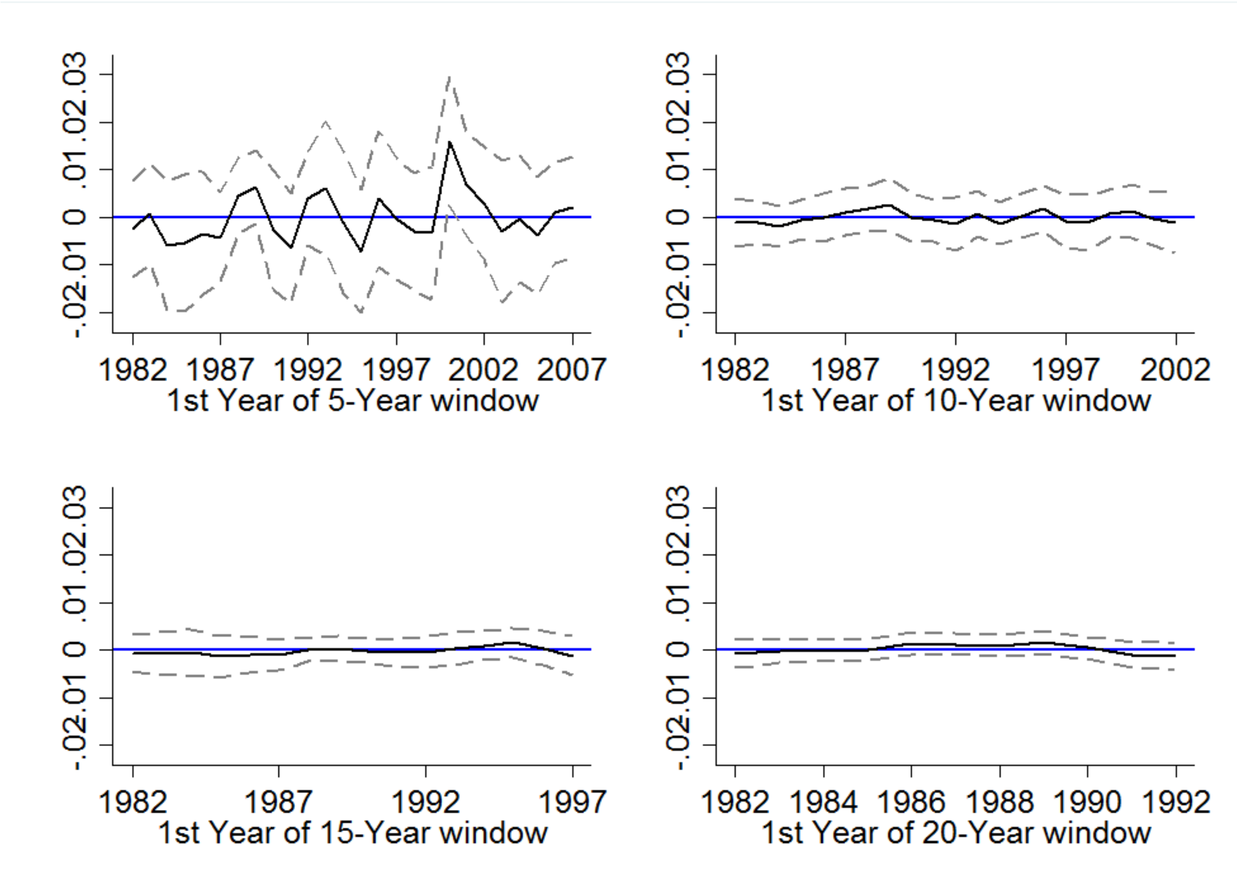
6 Figures and Tables

Figure 1: Area approach: Total Mortality and Unemployment Rates in France (Detrended and Normalized; 1982-2012; *Département* level)



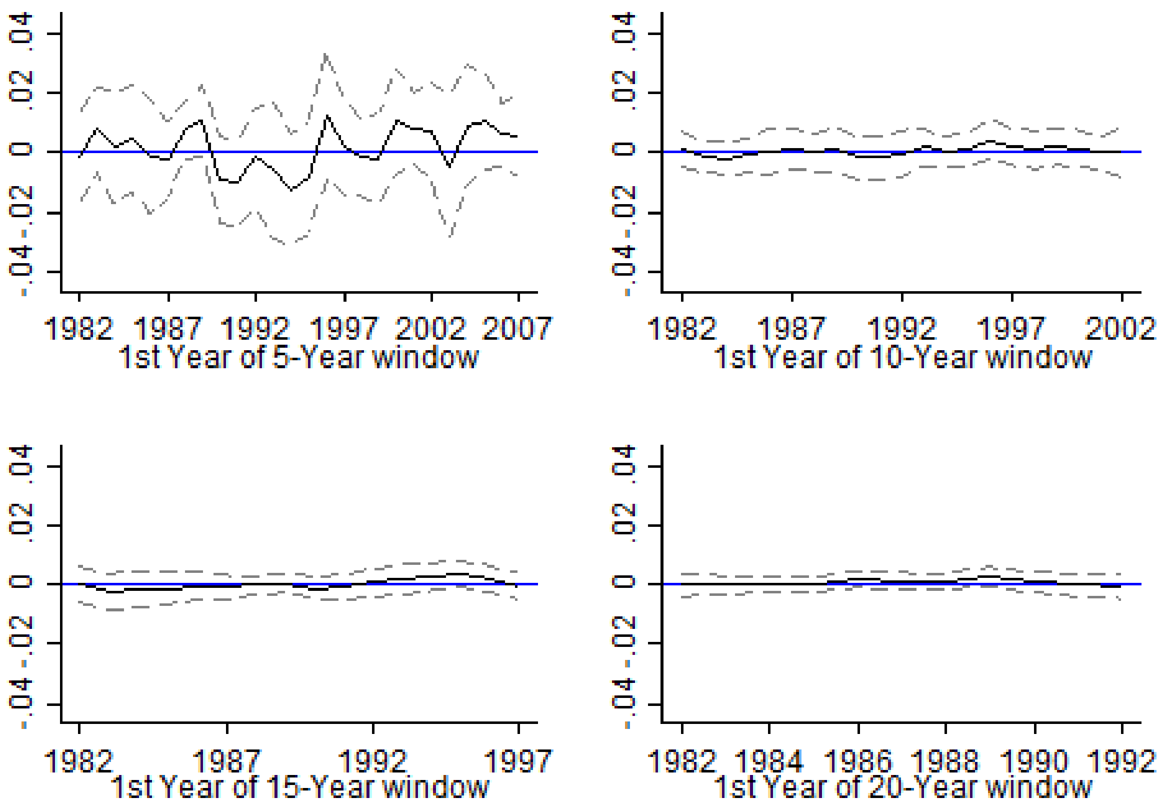
Notes: The dashed line provides unemployment rates over the period and the solid black line provides mortality rates (per 100,000). This figure is similar to the one provided by Buchmueller et al. (2007) in an unpublished working paper but updated for the period 2002-2012. The variables are detrended, using a linear trend and normalized by subtracting the mean of the detrended variable and dividing by its standard deviation.

Figure 2: Area approach: *Département* Unemployment coefficients for total mortality using different sample windows (1982-2012; *Département* level).



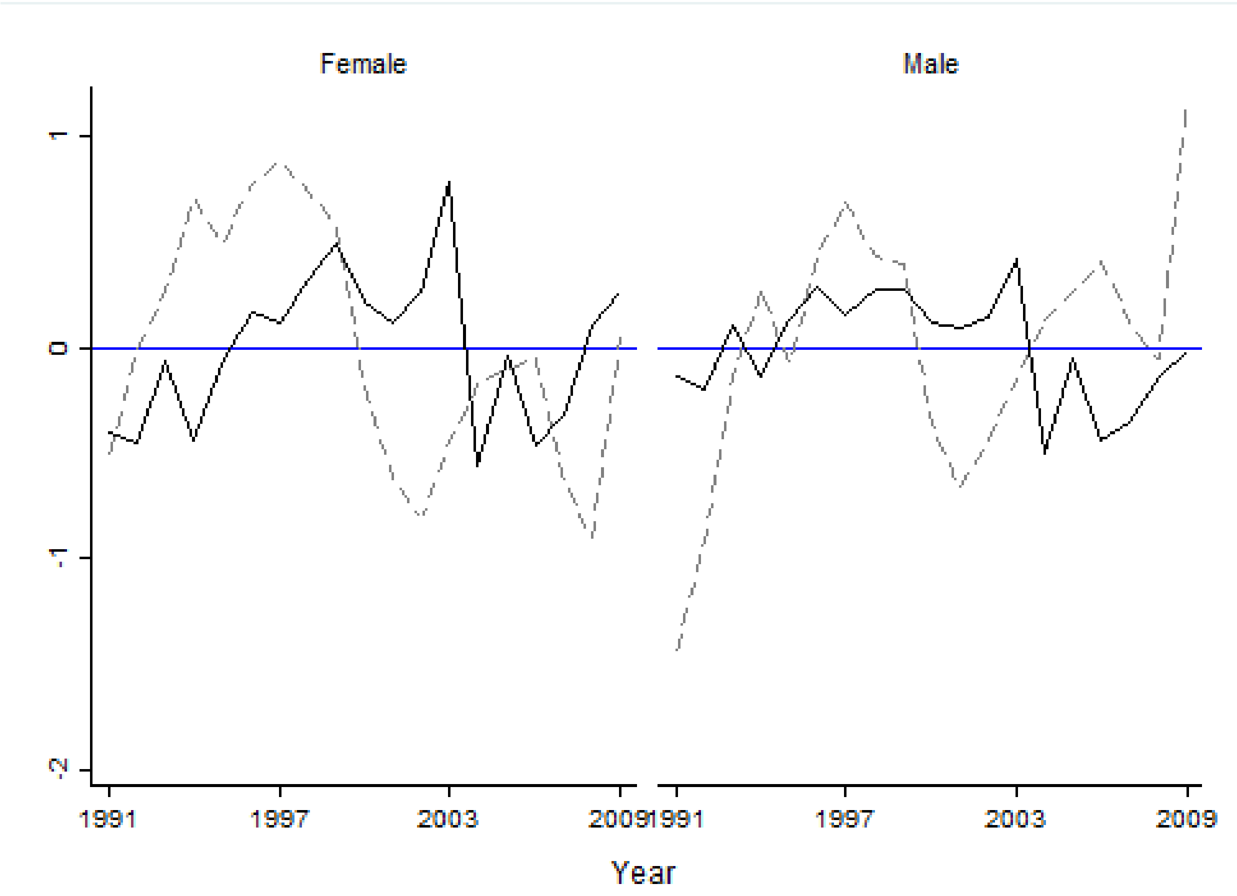
Notes: The solid black line provides unemployment coefficients over the period and the dashed lines provide 95% confidence intervals.

Figure 3: Area approach: *Région* Unemployment coefficients for total mortality using different sample windows (1982-2012; *Département* level).



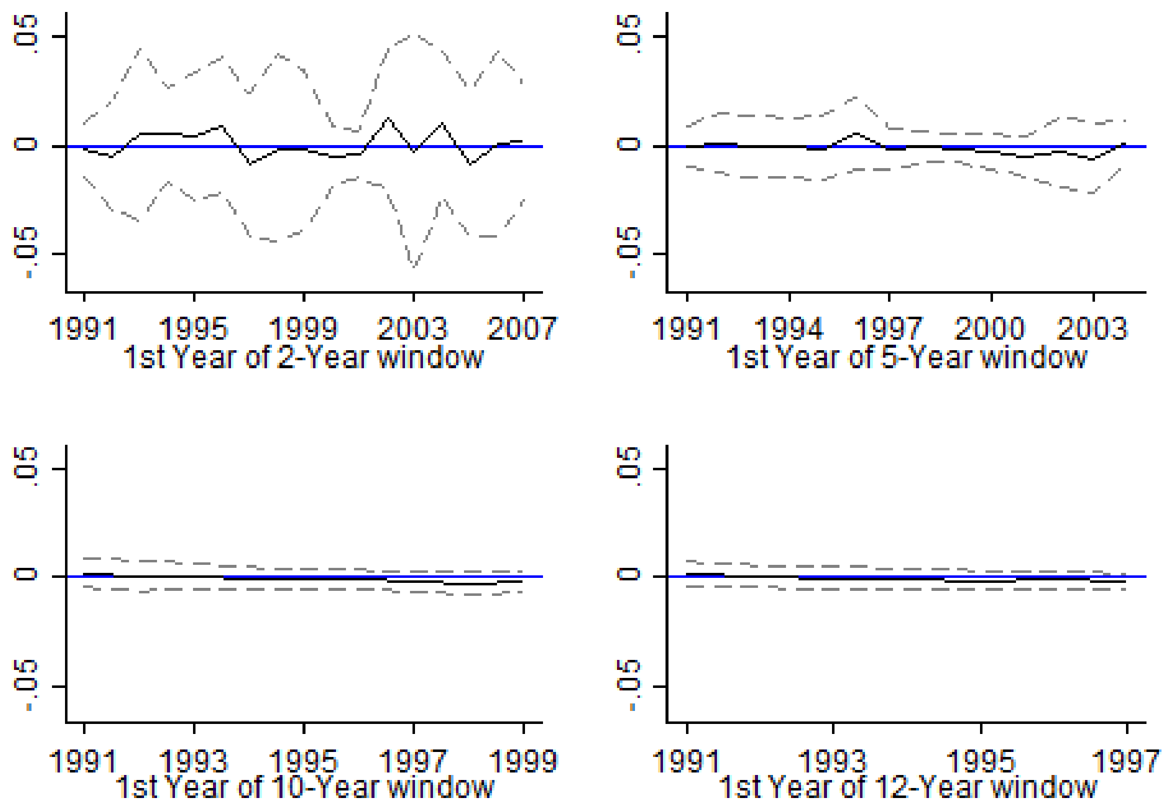
Notes: The solid black line provides unemployment coefficients over the period and the dashed lines provide 95% confidence intervals.

Figure 4: Area-Gender approach: *Département* Total Mortality and *Région* Unemployment Rates in France (Detrended, Adjusted on Gender and Normalized; 1991-2009)



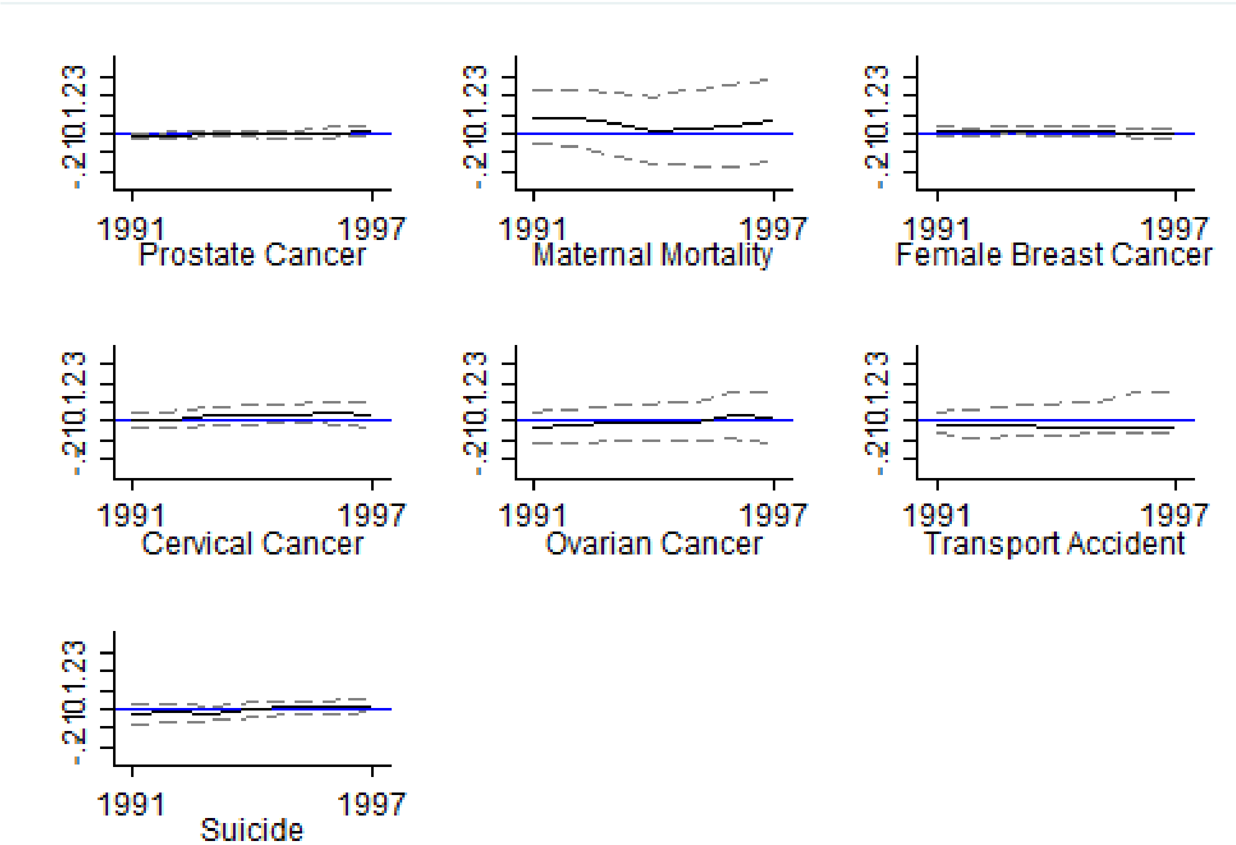
Notes: The dashed line provides unemployment rates over the period and the solid black line provides mortality rates (per 100,000). The variables are detrended, using a linear trend and gender fixed-effects, and normalized by subtracting the mean of the detrended variable and dividing by its standard deviation.

Figure 5: Area-Gender approach: Regional Unemployment coefficients for total mortality using different sample windows (1991-2009; *Département* level).



Notes: The data on gender-specific unemployment are provided at regional level for 1991-2009. The solid black line provides unemployment coefficients over the period and the dashed lines provide 95% confidence intervals.

Figure 6: Area-Gender approach: Regional Unemployment coefficients for gender-cause specific mortality, transport accident and suicide (*Département* level; 1st year of 12-Year window).



Notes: The data on gender-specific unemployment are provided at regional level for 1991-2009. The solid black line provides unemployment coefficients over the period and the dashed lines provide 95% confidence intervals.

Table 1: Area approach: Estimated macroeconomic effects on specific sources of mortality.

	Département Unemployment Rates			*Région* Unemployment Rates		
	1982-2001	1993-2012	1982-2012	1982-2001	1993-2012	1982-2012
All	-0.001	-0.001	0.003**	-0.001	-0.001	0.004***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)
Age-specific (Years)						
0-24	-0.014	-0.013	-0.013**	-0.024**	-0.014	-0.007
	(0.010)	(0.016)	(0.007)	(0.012)	(0.018)	(0.009)
25-44	0.005	-0.009	0.014**	0.012	-0.017*	0.017***
	(0.009)	(0.008)	(0.005)	(0.010)	(0.009)	(0.006)
45-64	-0.001	-0.003	0.006**	-0.001	-0.002	0.005
	(0.004)	(0.003)	(0.002)	(0.004)	(0.004)	(0.003)
65-74	0.001	-0.005	-0.003	0.000	-0.009**	-0.007*
	(0.003)	(0.004)	(0.003)	(0.005)	(0.004)	(0.004)
75-more	0.001	0.000	0.007***	0.004	0.003	0.011***
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.003)
Sex-specific						
Males	0.000	-0.002	0.004**	-0.001	-0.001	0.005**
	(0.002)	(0.002)	(0.001)	(0.003)	(0.002)	(0.002)
Females	-0.003	-0.002	0.000	-0.001	0.000	0.002
	(0.002)	(0.002)	(0.001)	(0.003)	(0.003)	(0.002)

Notes: Dependent variable is the natural log of the specified *département* mortality rate, obtained from the CépiDc, for 1982 to 2012 (n = 2,976). The first two columns show the coefficient on the *département* unemployment rate for 20-year subsamples (n = 1,920) covering 1982–2001 and 1993–2012. The last three columns show the coefficient on the *région* unemployment rate for the same periods. The regressions also include vectors of *département*, year dummy variables, *département*-specific linear time trends, and controls for the share of the *département* population who are aged < 5, 5–65, > 65. Robust standard errors, clustered at the *département* level, are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 2: Area approach: Estimated macroeconomic effects on cause-specific mortality.

	Département Unemployment Rates			*Région* Unemployment Rates		
	1982-2001	1993-2012	1982-2012	1982-2001	1993-2012	1982-2012
Diseases						
Cardivascular diseases	-0.002	-0.005**	0.005***	-0.001	-0.005	0.005**
	(0.002)	(0.003)	(0.002)	(0.003)	(0.003)	(0.002)
Malignant neoplasms (all types)	-0.004	-0.001	0.000	-0.001	-0.003	0.001
	(0.002)	(0.003)	(0.001)	(0.003)	(0.003)	(0.001)
Gender-cause specific						
Prostate cancer	-0.004	-0.003	-0.005	0.005	-0.01	-0.004
	(0.008)	(0.008)	(0.004)	(0.011)	(0.010)	(0.005)
Maternal Mortality	0.081	0.097**	0.083**	0.125*	0.132**	0.092**
	(0.055)	(0.046)	(0.026)	(0.070)	(0.063)	(0.031)
Female Breast Cancer	0.014	0.008	0.014**	0.01	0.014	0.015**
	(0.009)	(0.008)	(0.005)	(0.011)	(0.010)	(0.005)
Cervical Cancer	0.017	0.001	0.005	0.030	-0.007	-0.001
	(0.034)	(0.027)	(0.015)	(0.045)	(0.038)	(0.019)
Ovarian Cancer	-0.005	0.038**	0.008	0.001	0.033*	0.009
	(0.013)	(0.015)	(0.008)	(0.019)	(0.017)	(0.012)
Mental Health						
Alcohol problems	0.011	-0.010	0.015	0.000	0.002	0.021*
	(0.018)	(0.020)	(0.009)	(0.019)	(0.022)	(0.013)
Drugs addiction	0.022	0.038	0.074**	-0.022	0.031	0.085*
	(0.060)	(0.039)	(0.034)	(0.071)	(0.048)	(0.043)
External causes						
Transport accidents	-0.018	-0.035**	-0.017**	-0.020	-0.033*	-0.015*
	(0.012)	(0.015)	(0.007)	(0.014)	(0.018)	(0.008)
All accidents	-0.005	-0.004	-0.002	-0.007	-0.006	0.001
	(0.004)	(0.006)	(0.004)	(0.006)	(0.006)	(0.005)
Suicides	0.013	-0.013	0.008	0.006	-0.01	0.014
	(0.009)	(0.014)	(0.009)	(0.013)	(0.015)	(0.011)
Homicides	0.006	-0.051	-0.008	0.003	-0.059	-0.007
	(0.036)	(0.049)	(0.026)	(0.043)	(0.055)	(0.029)
Poisoning/Noxious	-0.006	-0.011	0.004	-0.045	-0.029	-0.004
	(0.035)	(0.034)	(0.016)	(0.044)	(0.038)	(0.019)

Notes: Dependent variable is the natural log of the specified *département* mortality rate, obtained from the CépiDc, for 1982 to 2012 (n = 2,976). The first two columns show the coefficient on the *département* unemployment rate for 20-year subsamples (n = 1,920) covering 1982–2001 and 1993–2012. The last three columns show the coefficient on the *région* unemployment rate for the same periods. The regressions also include vectors of *département*, year dummy variables, *département*-specific linear time trends, and controls for the share of the *département* population who are aged < 5, 5–65, > 65. Robust standard errors, clustered at the *département* level, are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 3: Area-Gender approach: Estimated macroeconomic effects on specific sources of mortality.

	Région Unemployment Rates (1991-2009)		*Département* Unemployment Rates (Census Years: 1982, 1990, 1990, 2006, 2011)	
	(1)	(2)	(3)	(4)
	UN	UN UN x Male	UN	UN UN x Male
All	-0.002	-0.004	0.001	0.001
	(0.002)	(0.003)	(0.002)	(0.002)
	-	0.002	-	0.471**
		(0.003)		(0.231)
Age-specific (Years)				
0-24	0.002	0.043	0.014	0.014
	(0.017)	(0.028)	(0.025)	(0.025)
	-	-0.063*	-	-0.168
		(0.037)		(4.308)
25-44	0.002	0.043	0.000	0.000
	(0.017)	(0.028)	(0.015)	(0.015)
	-	-0.063*	-	0.061
		(0.037)		(1.326)
45-64	-0.003	-0.005	-0.004	-0.004
	(0.006)	(0.007)	(0.008)	(0.008)
	-	0.003	-	-0.264
		(0.009)		(0.915)
65-74	-0.006	-0.009	-0.008	-0.007
	(0.006)	(0.008)	(0.011)	(0.010)
	-	0.004	-	-0.962
		(0.009)		(0.855)
75-more	-0.003	-0.010	-0.005	-0.005
	(0.006)	(0.008)	(0.011)	(0.011)
	-	0.010	-	-0.218
		(0.009)		(0.950)

Notes: Dependent variable is the natural log of the specified *département*-gender mortality rate, obtained from the CépiDc, for 1991 to 2009 (n = 3,648). The first two columns show the coefficient on the *région*-gender unemployment rate from 1991-2009. The last two columns show the coefficient on the *département*-gender unemployment rate for the census years (n = 960).The regressions also include vectors of *département*, year dummy variables, *département*-specific linear time trends, and controls for the share of the *département* population who are aged < 5, 5–65, > 65. Robust standard errors, clustered at the *département* level, are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4: Area-Gender approach: Estimated macroeconomic effects on specific sources of mortality.

	Région Unemployment Rates (1991-2009)		*Département* Unemployment Rates (Census Years: 1982, 1990, 1990, 2006, 2011)	
	(1)	(2)	(3)	(4)
	UN	UN UN x Male	UN	UN UN x Male
Diseases				
Cardivascular diseases	0.002	0.004	0.002	0.002
	(0.003)	(0.005)	(0.003)	(0.003)
	-	-0.003	-	0.687*
		(0.005)		(0.363)
Malignant neoplasms (all types)	-0.004	-0.007	-0.007*	-0.007*
	(0.004)	(0.007)	(0.004)	(0.004)
	-	0.005	-	0.09
		(0.007)		(0.494)
Mental Health				
Alcohol problems	0.006	0.045	0.028	0.028
	(0.025)	(0.043)	(0.038)	(0.038)
	-	-0.060	-	-0.186
		(0.048)		(4.405)
Drugs addiction	0.054	-0.025	0.418	0.426
	(0.087)	(0.158)	(0.436)	(0.462)
	-	0.099	-	6.603
		(0.194)		(41.575)
External causes				
Transport accidents	-0.015	-0.052**	-0.017	-0.017
	(0.015)	(0.023)	(0.025)	(0.025)
	-	0.058**	-	-1.717
		(0.027)		(2.569)
All accidents	-0.003	-0.008	0.007	0.007
	(0.006)	(0.009)	(0.011)	(0.011)
	-	0.007	-	0.15
		(0.011)		(0.714)
Suicides	-0.010	-0.006	0.036	0.036
	-(0.013)	-(0.018)	(0.022)	(0.022)
	-	-0.006		0.663
		-(0.022)		(1.993)
Homicides	-0.090*	-0.164*	0.009	0.018
	(0.047)	(0.089)	(0.094)	(0.095)
	-	0.106	-	4.002
		(0.100)		(7.702)
Poisoning/Noxious	0.029	-0.047	-0.071	-0.072
	(0.046)	(0.069)	(0.055)	(0.055)
	-	0.107	-	-3.724
		(0.065)		(6.888)

Notes: Dependent variable is the natural log of the specified *département*-gender mortality rate, obtained from the CépiDc, for 1991 to 2009 (n = 3,648). The first two columns show the coefficient on the *région*-gender unemployment rate from 1991-2009. The last two columns show the coefficient on the *département*-

gender unemployment rate for the census years (n = 960). The regressions also include vectors of *département*, year dummy variables, *département*-specific linear time trends, and controls for the share of the *département* population who are aged < 5, 5–65, > 65. Robust standard errors, clustered at the *département-gender* level, are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 5: Area-Gender approach: Estimated macroeconomic effects on specific sources of mortality.

	Région Unemployment Rates (1991-2009)		*Département* Unemployment Rates (Census Years: 1982, 1990, 1990, 2006, 2011)	
	(1) UN - Same Gender	(2) UN - opposite Gender	(3) UN - Same Gender	(4) UN - opposite Gender
Prostate cancer	-0.014*	-0.019*	-0.007	0.000
	(0.008)	(0.011)	(0.011)	-(0.008)
Maternal Mortality	-0.003	0.005	0.065	0.119
	(0.051)	(0.036)	(0.074)	(0.112)
Female Breast Cancer	0.008	0.016**	0.004	0.007
	(0.011)	(0.008)	(0.006)	(0.010)
Cervical Cancer	-0.045	-0.023	0.018	0.007
	(0.039)	(0.025)	(0.023)	(0.034)
Ovarian Cancer	0.009	0.016	-0.010	-0.028*
	(0.016)	(0.013)	(0.013)	(0.015)

Notes: Dependent variable is the natural log of the specified *département*-gender mortality rate, obtained from the CépiDc, for 1991 to 2009 (n = 1,824). The first two columns show the coefficient on the *région*-gender unemployment rate from 1991-2009. The last two columns show the coefficient on the *département*-gender unemployment rate for the census years (n = 480). The regressions also include vectors of *département*, year dummy variables, *département*-specific linear time trends, and controls for the share of the *département* population who are aged < 5, 5–65, > 65. Robust standard errors, clustered at the *département-gender* level, are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 6: Area-Gender approach: robustness tests

	Région Unemployment Rates (1991-2009)						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Sub-sample; Panel	Sub-sample; Panel	Sub-sample; Panel	Sub-sample; Census	Not taking Log of Mortality; Panel	Alt. Measure of Econ Conditions; Panel	Alt. Measure of Econ Conditions; Census
Years analyzed	1991-2000	2000-2009	2006-2009	1990, 2006, 2011	1991-2009	1991-2009	1982-2011
UN	0.002	-0.006	0.002	0.000	4.390	-	-
	(0.007)	(0.006)	(0.022)	(0.016)	(20.936)		
UN x Male	-0.007	0.007	-0.001	0.117	-3.819	-	-
	(0.008)	(0.007)	(0.035)	(1.296)	(33.044)		
Emp-to-pop ratio	-	-	-	-	-	0.023	-0.128
						(0.019)	(0.086)
Emp-to-pop ratio x Male	-	-	-	-	-	0.023	0.095
						(0.019)	(0.100)

Notes: The regressions also include vectors of *département*, year dummy variables, *département*-specific linear time trends, and controls for the share of the *département* population who are aged < 5, 5–65, > 65. Robust standard errors, clustered at the *département-gender* level, are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A1: Definitions of specific causes of mortality.

	ICD-9 (1979-1998)	ICD-10 (1999-2010)	Estimated comparability ratio (Anderson et al., 2001)
Diseases			
Cardivascular diseases	390-459	I00-I99	0.998
Malignant neoplasms	140-239	C00-D48	1.006
Gender-cause specific			
Prostate cancer	185	C61	1.013
Maternal Mortality	630-676	O00-O99	NA
Female Breast Cancer	174-175	C50	1.005
Cervical Cancer	180-180	C53	0.987
Ovarian Cancer	183	C56	0.995
Mental Health			
Alcohol problems	291-303	F10	NA
Drugs addiction	304-305	F11-F16, F18-F19	NA
External causes			
Transport accidents	800-848	V01-V99	0.997
All accidents	800-928	V01-X59	1.030
Suicides	950-958	X60-X84	0.996
Homicides	960-968	X85-Y09	0.998
Poisoning/Noxious	850-869	X40-X49	NA

Table A2: Descriptive statistics: Sources of death by time period and gender.

	Female			Male		
	1982-2001	1993-2012	1982-2012	1982-2001	1993-2012	1982-2012
All	958.362	917.278	940.138	1085.211	1025.998	1058.923
Diseases						
Cardivascular diseases	373.357	305.576	343.197	338.671	282.253	313.786
Cancer (all types)	201.374	212.468	206.459	325.452	335.037	328.157
Gender-cause specific						
Prostate cancer	0.000	0.000	0.000	34.747	35.633	34.653
Maternal Mortality	0.258	0.181	0.230	0.000	0.000	0.000
Female Breast Cancer	34.961	37.645	35.904	0.000	0.000	0.000
Cervical Cancer	2.749	2.409	2.619	0.000	0.000	0.000
Ovarian Cancer	10.866	11.491	11.026	0.000	0.000	0.000
Mental Health						
Alcohol problems	1.915	1.837	1.919	9.053	8.192	8.873
Drugs addiction	0.129	0.129	0.114	0.700	0.735	0.632
External causes						
Transport accidents	9.917	6.247	8.138	28.412	18.309	23.755
All accidents	69.823	57.776	64.248	111.659	93.429	103.210
Suicides	11.677	10.059	10.943	32.226	30.333	31.193
Homicides	0.775	0.620	0.697	1.319	1.069	1.191
Poisoning/Noxious	0.835	1.538	1.193	0.948	1.794	1.427

Table A3: Area approach: Estimated macroeconomic effects on specific sources of mortality.

	Département Unemployment Rates		*Région* Unemployment Rates	
	1991-2009	Census Years	1991-2009	Census Years
All	0.000	0.004*	0.001	0.008***
	(0.001)	(0.002)	(0.002)	(0.003)
Age-specific (Years)				
0-24	-0.013	-0.018	-0.018	-0.016
	(0.014)	(0.021)	(0.015)	(0.025)
25-44	-0.003	0.015	-0.013	0.01
	(0.008)	(0.013)	(0.009)	(0.018)
45-64	0.001	0.002	0.001	0.002
	(0.004)	(0.005)	(0.004)	(0.006)
65-74	-0.006	0.003	-0.009**	-0.005
	(0.004)	(0.005)	(0.004)	(0.007)
75-more	0.003	0.010**	0.006**	0.017***
	(0.002)	(0.004)	(0.003)	(0.004)
Sex-specific				
Males	0.001	0.007**	0.002	0.010***
	(0.002)	(0.003)	(0.002)	(0.004)
Females	-0.003*	0.002	-0.002	0.005
	(0.002)	(0.003)	(0.002)	(0.004)

Notes: Dependent variable is the natural log of the specified *département* mortality rate, obtained from the CépiDc, for 1991 to 2009 (n = 1,824). Census years are 1982, 1990, 1999, 2006, 2011 (n=480). The regressions also include vectors of *département*, year dummy variables, *département*-specific linear time trends, and controls for the share of the *département* population who are aged < 5, 5–65, > 65. Robust standard errors, clustered at the *département* level, are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table A4: Area approach: Estimated macroeconomic effects on cause-specific mortality.

	Département Unemployment Rates		*Région* Unemployment Rates	
	1991-2009	Census Years	1991-2009	Census Years
Diseases				
Cardiovascular diseases	-0.002	0.009**	0.000	0.011**
	(0.002)	(0.004)	(0.003)	(0.005)
Malignant neoplasms (all types)	0.001	0.000	-0.001	-0.001
	(0.002)	(0.003)	(0.003)	(0.004)
Gender-cause specific				
Prostate cancer	-0.005	0.002	-0.015	0.002
	(0.007)	(0.015)	(0.011)	(0.018)
Maternal Mortality	0.123***	0.163	0.149***	0.268
	(0.037)	(0.160)	(0.053)	(0.231)
Female Breast Cancer	0.012	0.008	0.021**	0.003
	(0.008)	(0.014)	(0.010)	(0.017)
Cervical Cancer	-0.026	-0.001	-0.026	-0.032
	(0.024)	(0.051)	(0.035)	(0.057)
Ovarian Cancer	0.028*	-0.012	0.035*	0.008
	(0.015)	(0.023)	(0.018)	(0.033)
Mental Health				
Alcohol problems	0.001	0.058**	0.012	0.048
	(0.016)	(0.026)	(0.019)	(0.033)
Drugs addiction	0.045	0.036	0.081*	0.045
	(0.036)	(0.087)	(0.041)	(0.098)
External causes				
Transport accidents	-0.029**	-0.027	-0.034**	-0.018
	(0.012)	(0.017)	(0.014)	(0.022)
All accidents	-0.002	-0.005	-0.006	0.006
	(0.006)	(0.009)	(0.007)	(0.012)
Suicides	0.003	0.013	0.000	0.022
	(0.014)	(0.019)	(0.016)	(0.023)
Homicides	-0.035	0.005	-0.039	0.059
	(0.045)	(0.064)	(0.052)	(0.077)
Poisoning/Noxious	0.038	0.000	0.032	-0.031
	(0.035)	(0.053)	(0.041)	(0.060)

Notes: Dependent variable is the natural log of the specified *département* mortality rate, obtained from the CépiDc, for 1991 to 2009 (n = 1,824). Census years are 1982, 1990, 1999, 2006, 2011 (n=480). The regressions also include vectors of *département*, year dummy variables, *département*-specific linear time trends, and controls for the share of the *département* population who are aged < 5, 5–65, > 65. Robust standard errors, clustered at the *département* level, are shown in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.